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Modelling precession effects with a single effective precession parameter PATRICIA SCHMIDT, California Institute of Technology, FRANK OHME, MARK HANNAM, Cardiff University — Gravitational waves (GWs) from generic black-hole binaries show a rich structure that directly reflects the complex dynamics of the precessing orbital plane. Recent progress in modelling these signals relies on an approximate decoupling between the non-precessing secular inspiral and a precession-induced rotation. The latter depends in general on all physical parameters of the binary which significantly complicates modelling efforts. We show that the dominant precession effects can be captured by a single effective precession spin parameter, χ_p, which is defined from the spin components that lie in the instantaneous orbital plane at some time during the inspiral. We show that for an overwhelming majority of random precessing configurations, the precession dynamics during the inspiral is well approximated by corresponding configurations defined from a subset of physical parameters. Our results suggest that in that in the comparable-mass regime waveform models with only three spin parameters faithfully represent generic waveforms, which has practical implications for the prospects of GW searches, parameter estimation and the numerical exploration of the precessing-binary parameter space.

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